Processing Techniques

The following section is devoted to manual processing of films and papers. If large quantities of films or papers must be processed daily, or if negatives must be processed in a minimum of time, investigate the possibilities of mechanized processing.

PROCESSING FILMS

Tank development with intermittent agitation is recommended for both roll and sheet films. A tank lets you produce clean, evenly developed negatives, and at the same time permits accurate control of development factors. Tank development is the most practical method of processing 35 mm films.

In the development of films, certain methods of agitation must be followed to develop the film uniformly and keep it free from developer flow marks. Development irregularities due to improper agitation are a principal cause of many poor-quality negatives. Such effects as edge intensification, streaks, irregular densities, and mottle are caused by insufficient or excessive agitation, but can be avoided by following the various recommended procedures.

When films receive little or no agitation, or are allowed to remain undisturbed for long periods without agitation, the accumulation of development by-products adjacent to the film is not replaced adequately by fresh developer solution, and uneven development results. With excessive agitation, intensified edge development may occur because of the greater turbulence of developer around the edges of the film, or through the perforations of developing hangers.

Where volume of work warrants its installation, the gaseous burst method of agitation provides the most nearly ideal method for practical photographic service. It is reasonably economical and, because it is automatic, does not require full-time attention. This method is not, however, recommended for use with films in spiral reels. More detailed information can be found in KODAK Publication No. E-57, *Gaseous-Burst Agitation in Processing.* Single copies are available on request from Department 412-L, Eastman Kodak Company, 343 State Street, Rochester, New York 14650.

The several procedures described in the following pages will produce uniform, high-quality results. These instructions assume correct use of the recommended safelight.

Unloading Film Magazines and Cartridges

Carry out the following procedures in total darkness.

Size 135 Magazines

Using a bottle-cap opener, lift the metal cap from either end of the magazine (the end where the spool does not project is generally the easier one to open). Draw the loaded spool out, taking care not to let the film unwind itself. Feed the film into any standard 35 mm processing reel.

Size 126 Cartridges

Using both hands, grasp the two cylindrical chambers of the exposed 126 cartridge. Break the cartridge in half by bending the chambers toward the label. Remove the film spool from the large chamber by separating the plastic sections surrounding the spool. Unroll the film and the paper backing.

Size 110 Cartridges

Using both hands, grasp the 2 cylindrical chambers of the exposed 110 cartridge. Hold the cartridge with the label facing you and your thumbs on the label. Break the cartridge by bending the chambers back. Next, pull the film and its paper backing from the take-up chamber. (Pull so that the *paper* rubs against the inner surface of the cartridge back. This precaution minimizes the likelihood of scratching the emulsion.) If the film trailer has been wound into the take-up chamber, you will have to pry open the chamber (after breaking the cartridge) to retrieve it.

Small-Tank Development: Roll Films, Film Packs, and Small Sizes of Sheet Film (in Tanks with Removable Reels or Racks)

Fill the tank with developer at the recommended temperature, turn off the light, load the film on the reel, and proceed as follows:

1. Start the timer. Place the loaded reel in the tank containing the developer and secure the lid. Bang the tank sharply on the bottom of the sink or counter several times to dislodge air bubbles that cling to the film.
2. Turn on the lights and begin agitating the film at a rate of about 4 inversion cycles (down, up) every 30 seconds. Each inversion cycle should take about 1 second. If the tank

cannot be inverted without spilling the developer, slide it around in circles on the counter for the same length of time. For agitation of KODAK Technical Pan Film in KODAK TECHNIDOL LC and Liquid Developers, see pages 42-43.

3. Pour out the developer and fill the tank with KODAK Indicator Stop Bath or KODAK Stop Bath SB-5, at 18.5 to 24°C (65 to 75°F). Agitate continuously for about 30 seconds. For a water rinse, empty and refill the tank several times with fresh water of approximately the same temperature.
4. Pour the fixing bath into the tank and agitate the tank as above for about 30 seconds. Repeat several times during fixing.
5. When fixing is complete, wash the negatives for 30 minutes in running water. This can be done in the uncovered tank. Empty the tank at 5-minute intervals to obtain more thorough washing.

Tank Development: Sheet Films in Hangers

Do not develop more films in a tank than can be accommodated with at least a 1-centimetre (1/2-inch) separation between each sheet. A 3 1/2-gallon KODAK Hard Rubber Tank accommodates twelve 8 x 10-inch KODAK Film and Plate Developing Hangers No. 4A. For ease in handling batches of hangers, use the KODAK Developing Hanger Rack No. 40. This rack takes twelve 8 x 10-inch film hangers and fits into the 3 1/2-gallon hard rubber tanks. As a safeguard against the films touching one another during processing, and to maintain even separation between the films, use KODAK Hanger Separators (for KODAK Developing Hanger Rack No. 40), supplied in a set of two.

Arrange the tanks so that the plane of the films will be parallel to the front edge of the bench or sink. With the processing solutions at the recommended temperature, turn out the light, load and assemble the developing hangers, and proceed as follows:

1. Start the timer. Lower the hangers as a unit smoothly and carefully into the developer. Immediately tap the hangers sharply 2 or 3 times on the upper edge of the tank to dislodge any air bubbles clinging to the emulsion. Check the spacing of the hangers to make certain that they are at least 1 centimetre (1/2-inch) apart.
2. Then lift, tilt, and drain the hangers 2 times each minute. Tilt the hangers to the right one time, then to the left the next to get even development. Reimmerse the hangers quickly into the solution after each cycle and check their spacing. The entire cycle of lifting and reimmersion should be as rapid as possible without interfering with smooth operation. It should be completed in about 5 to 7 seconds. *Caution:* With films larger than 5 x 7 inches (12.7 x 17.8 centimetres), take care not to lift or immerse them so quickly that the films are pulled from the hangers.
3. When development is complete, lift the hangers from the developer, drain them for 2 or 3 seconds, and transfer them to the stop bath or rinse water. Lift and reimmerse the hangers several times before transferring them to the fixing bath.
4. Lift and reimmerse the hangers several times at the beginning of fixing and again at the end of the first minute. Allow them to remain until fixing is complete. Separation of the hangers and frequent agitation will shorten fixing time.

Tray Development: Single Sheet of Film

Tray development of a single sheet of film can be accomplished best by placing about 1 centimetre (1/2 inch) of developer in a tray somewhat larger than the film. With the solutions at the proper temperature, proceed as follows:

1. Start the timer and immediately slide the film, emulsion side up, smoothly into the developer. Agitate the tray continuously throughout development as follows:

   Raise the left side of the tray about 1 to 2 centimetres (1/2 to 3/4 inch), lower it smoothly, and then immediately raise and lower the near side similarly. Next, raise and lower the right side, and then again the near side. These four operations constitute an *agitation cycle,* which requires a total time of about 8 seconds.
2. When development is complete, rinse the negative in a separate tray with agitation for several seconds in fresh water or a stop bath.
3. Transfer the film to the fixing bath and agitate by rocking the tray as described above for about 30 seconds. Repeat the agitation at intervals for the duration of the fixing time.
4. Wash the negative in running water for 20 to 30 minutes.

Tray Development: Several Sheets of Film

The following method of developing 2 to 6 sheets of film in a tray is capable of producing good negative uniformity. However, take considerable care to prevent scratches or finger marks. Also, the temperature of the developer should not exceed the recommended range, and the use of highly alkaline developers such as D-8, D-11, and D-19 should be avoided to prevent softening of the gelatin. A modification of this procedure is recommended for tray development of color-separation negatives.

Using trays slightly (next size) larger than the film sheets and with the solutions at the proper temperature, follow these steps:

1. Immerse the exposed sheets one at a time and emulsion side up in a tray of water, at not above 24°C (75°F). The topmost sheet must be completely covered with water before the next one is placed over it. When all the sheets are in the tray, draw one carefully from the bottom and place it on top. Handle the film only by the extreme edges, and take care to prevent a corner of it from digging into the emulsion of the sheet on the top of the pile. Repeat this replacement from bottom to top until all sheets have been leafed through twice. This prewetting procedure will prevent sheets from sticking together and also dislodge any air bubbles which may have formed.
2. Start the timer and transfer the sheets quickly, one at a time, from the bottom of the pile into the developer tray. Briefly drain each sheet before transferring it. Continue the rotation of film sheets from bottom to top throughout the period of development. At intervals, turn the sheets 90°, emulsion side up, as you place them on the top of the pile.
3. When development is complete, transfer the sheets, one at a time, to the stop bath and leaf through the pile twice. Contamination of the developer with the stop bath can be avoided by using one hand for removing the films from the developer and the other hand for immersing them in the stop bath.
4. Place the sheets, one at a time, in the fixing bath. Continue the replacement from bottom to top 2 or 3 times continuously—then at intervals until the negatives are completely fixed.
5. Wash the negatives in running water for 20 or 30 minutes by continuing the rotational method or by placing the negatives in developing hangers and using a washing tank.

DRYING FILMS

After washing, grit and scum should be swabbed under water from the emulsion with a tuft of cotton applied. As soon as the film is taken from the wash water for drying, water droplets should be removed with a damp KODAK Photo Chamois or soft viscose sponge. Or you can bathe the negatives in diluted KODAK PHOTO-FLO Solution for about 30 seconds and then let them drain. The negatives preferably should be removed from the channel-type hanger before drying.

Dry the negatives in a warm, dry room free from dust and excessive drafts, or in a cabinet supplied with warm, filtered air.

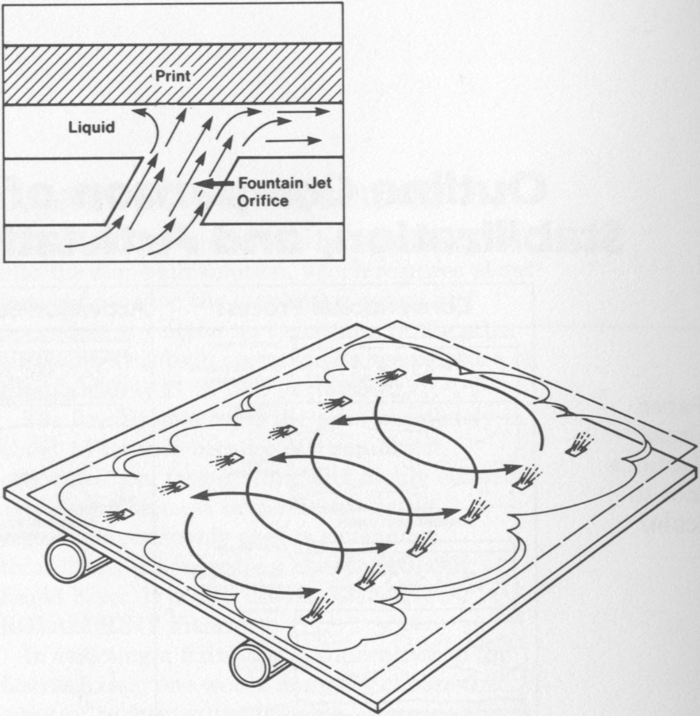
DEVELOPING TIMES

Developing recommendations for various Kodak films are given in the instructions packaged with the materials. The developing times suggested will usually produce a degree of development suitable for the types of work for which each material is most often used. Longer or shorter times can be used if experience indicates that an increase or decrease in the degree of development would be desirable for the particular working conditions and the type of camera and printing equipment in use.

The times given in connection with each developer formula, and on the labels of packaged developers, are average times that give good results with most materials. Naturally, they cannot agree exactly with the different times which are recommended specifically for each individual material.

The recommended development temperature for most films is 20°C (68°F), but many films can now be satisfactorily developed at higher and lower temperatures. Instructions packaged with most Kodak films give development times for various appropriate developers at temperatures ranging from 18.5 to 24°C (65 to 75°F). For development at temperatures above 24°C (75°F), follow the method outlined under **High-Temperature Processing,** page 34.

The developing dial in the *KODAK Complete Darkroom DATAGUIDE,* R-18, provides a convenient means for determining the development times needed to produce approximately equal degrees of development with a large number of combinations of Kodak films and developers. It also provides a very convenient means for adjusting the times if a higher or lower degree of development is desired.



High-turbulence, fountain-jet agitation fixer and washer stages.

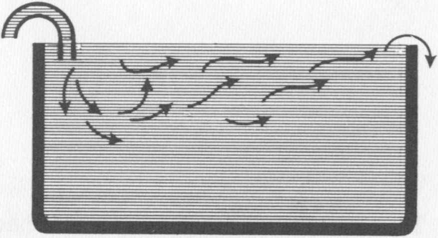


Figure 1: Poor wash-tank design. Note that the water is turbulent only near the top of the tank.

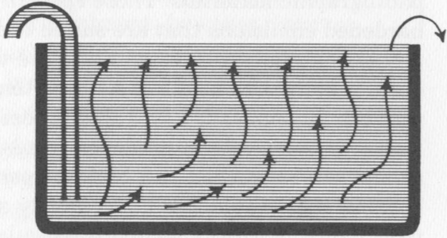


Figure 2: Good wash-tank design, producing turbulence throughout the tank.